

IPM CRSP Working Paper 01-2

(October 2001)

Baseline II: A Follow-up Survey of Farmer Pest Management Practices and IPM Knowledge Diffusion

**J. Mark Erbaugh¹, D. Taylor², S. Kyamanywa³, P. Kibwika⁴,
V. Odeke⁵, and E. Mwanje⁶**

**IPM CRSP
Office of International Research and Development
1060 Litton Reaves Hall
Virginia Tech
Blacksburg, VA. 24061-0334**

¹ Rural Sociologist & Site Chair, The Ohio State University, USA

² Agricultural Economist, Virginia Tech, USA

³ Entomologist & Site Coordinator, Makerere University, Uganda

⁴ Agricultural Extension Education, Makerere University, Uganda

⁵ Agricultural Extension, Kumi District, Ministry of Agriculture & Animal Industries, Uganda

⁶ Agricultural Extension, Iganga District, Ministry of Agriculture & Animal Industries, Uganda

Contact Address for the Management Entity

IPM CRSP
Office of International Research and Development
1060 Litton Reaves Hall
Virginia Tech
Blacksburg, VA 24061-0334
Telephone (540) 231-6338
FAX: (540) 231-3519
E-mail: BRHANE@vt.edu

U.S. Institutions

Florida A&M University	Purdue University
Fort Valley State University	U. of California/Davis/Riverside
Lincoln University	Univ. of Maryland/Eastern Shore
Montana State University	University of Georgia
North Carolina A&T University	USDA Vegetable Lab
Ohio State University	Virginia Tech
Penn State University	

Host Country Institutions

Albania: AUT, FTRI, PPRI	Ecuador: INIAP
Bangladesh: BARC, BARI, BRRI	Honduras: EAP
Jamaica: CARDI, Ministry of Agriculture	Mali: IER
Guatemala: Agri-Lab, ALTERTEC, ICTA	Uganda: Makerere Univ.
Philippines: NCPC/UPLB, PhilRice	

International Centers

AVRDC - Taiwan	ICIPE - Kenya
CIP - Peru, Ecuador	IRRI - Philippines
CIAT -Colombia	

Private Sector

The Kroger Company	Caito Foods
PICO	NOGROCOMA

NGOs/PVOs

CLADES

This publication was made possible through support provided by the U.S. Agency for International Development (USAID), under the terms of Grant No. LAG-G-00-93-00053-00 made to Virginia Polytechnic Institute and State University (Virginia Tech) for the Integrated Pest Management Collaborative Research Support Program (IPM CRSP).

The opinions expressed herein are those of the authors and do not necessarily reflect the view of USAID.

Working Papers are intended to stimulate discussion and elicit comments from interested professionals, both within and outside the IPM CRSP. They are not reviewed publications.

They may be cited with due acknowledgement.

=====

Abstract

The IPM CRSP/ Uganda Site is one of eight research sites that are part of the Global IPM CRSP Program financed by USAID. Since mid-1995, the IPM CRSP has been working with farmers in Iganga and Kumi Districts in Eastern Uganda. A follow-up baseline survey was conducted in these two districts during March and April, 1999. The main purpose of this working paper is to present the descriptive findings from this survey.

A multi-stage sampling procedure was used to select eight villages in the two subject districts. A systematic random sample of 25 farmers was selected from each village, totaling 100 interviews in each district, and 200 interviews in all. The information and results obtained through this survey are presented and discussed in several sections including an introduction to the study areas, the methodology used, a socio-demographic profile of farmers interviewed, crop production and marketing, farmers' knowledge of pests and pest management, an analysis of project impacts on farmer knowledge and awareness of IPM, and a concluding section on factors that might promote or impede adoption and diffusion of IPM.

Results indicate that pest and disease priorities established by farmers for each of the priority crops during the participatory assessment conducted in 1995 are still relevant. The one major change is that farmers in Kumi District now rank the leaf miner (*Aroarema*

modicella) as the most important problem on groundnuts surpassing for the first time, aphids and groundnut rosette virus.

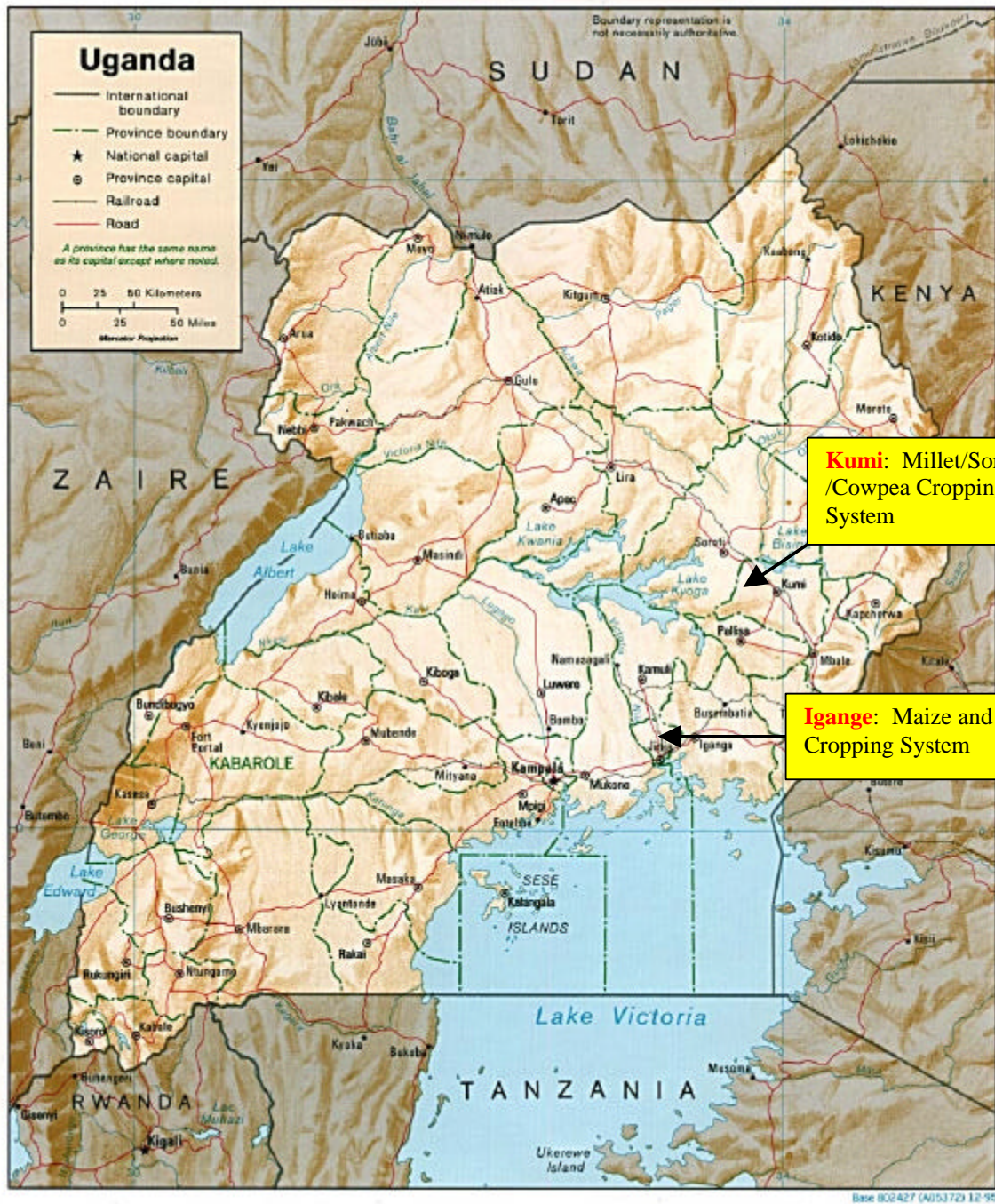
Farmers in both districts continue to rely on synthetic pesticides as their primary method to control pests and diseases. Sixty-three and thirty three percent of the farmer reported using synthetic pesticides on their field crops and in post-harvest storage respectively. The crops most likely and frequently to be sprayed are cowpea and groundnuts.

Although more than half of the farmers have some safety concerns regarding the use of pesticides, nearly seventy percent believe that pesticides lead to increased yields and seventy one percent would like to use more pesticides. Seventy three percent of the farmers indicated that over the last four years their use of pesticides has increased. It appears that in the absence of alternatives, the use of pesticides is proliferating.

An assessment of project impacts using comparison groups of farmers who had and had not participated in project activities indicates that those who participated in more project activities have greater knowledge of IPM than those who had not participated. This provides preliminary support for the participatory research and extension approach being used by the IPM CRSP in Uganda. However, the analysis provides evidence that the number of project beneficiaries is limited and may be more socio-economically advantaged.

Future efforts will investigate the adoption of IPM technologies and attempt to broaden project impacts.

Map of Uganda



1. Introduction

1.1. The IPM CRSP/ Uganda Site

The IPM CRSP/ Uganda Site is one of eight research sites that are part of the Global IPM CRSP Program. Since mid-1995, the IPM CRSP has been active in Iganga and Kumi districts located in Eastern Uganda. The first project activity was a participatory assessment (PA) conducted in the sub-counties of Bulamogi and Baitambogwe in Iganga, and Malera and Bukedea in Kumi, with farmer NGO groups in each sub-county. The PA established the priority crops as maize, beans and groundnuts in Iganga and sorghum, cowpea and groundnuts in Kumi. In 1996, the first baseline was conducted and a farmer crop pest monitoring system was implemented with 5 farmers from each NGO. During the second season 1997, on-farm trials were initiated with cooperating farmers from each NGO group. A farmer evaluation of these trials was conducted during the first season 1998, and farmer-led field days were held the second season 1998. On-farm trials continued and the second baseline survey was conducted and completed during the months of March and April 1999.

1.2 The Follow-Up Baseline Survey

The follow-up baseline survey was conducted in Iganga and Kumi districts during March and April 1999. The main objectives of this second baseline were to: 1) provide a socio-demographic profile of farmers and their production practices; 2) broaden knowledge base of priority pests and pest management practices used by farmers; 3) evaluate impact of IPM CRSP activities to-date on farmers= knowledge and awareness of IPM; and, 4) assess factors that facilitate or impede diffusion and adoption of IPM in districts where the IPM CRSP has been active. The main purpose of this working paper is to present a comprehensive descriptive analysis of information collected from the follow-up baseline survey. More in depth analyses will appear in future publications.

1.3 Profile of the Study Area

The dominant cereal/legume production systems found in Iganga and Kumi districts are characteristic of those found throughout much of Eastern Uganda. However, each district can be differentiated by amount of rainfall, population density, ethnic make-up, use of animal traction, and the specific cereal legume cropping system. Iganga district has a distinct bi-modal rainfall distribution (1250mm-2200mm), minimal use of animal traction and a cereal/legume cropping system consisting of maize and beans. Iganga has a relatively high population density (196/Km²), largely populated by a Bantu speaking people (Soga). Kumi district has a less pronounced bi-modal rainfall distribution (1000mm-1400mm) that is prone to periodic drought, traditional reliance on animal traction, and a cereal/legume cropping system consisting of millet/sorghum/cowpea. Kumi has a lower population density (96/Km²), populated by a Nilo-Hamitic speaking people (Teso). Groundnuts are grown in both districts, particularly in Kumi but also in central and northern Iganga.

2. Methods

2.1 Instrument Development

The instrument for the second baseline survey was based on a previous version used to study the socioeconomic background and pest management practices of farmers in the same districts in 1996. Selected questions from surveys used at other IPM CRSP sites, and revisions and suggestions supplied by enumerators were added to the instrument. In addition, a series of questions that required farmers to identify pests and diseases from enlarged photos was added. A set of these enlargements was provided to each enumerator.

A pre-test of the instrument was conducted by teams of enumerators in their respective districts. In Kumi the pre-test occurred on February 26th with 3 farmers and in Iganga on March 1st with 3 farmers. Minor revisions to the instrument were made and a final instrument was completed, copied and distributed to field coordinators on March 3.

2.2 Enumerator Training

A one-day enumerator-training workshop was held at the Hotel Triangle in Jinja on February 24th. There were 13 people present at the workshop, including all enumerators and field coordinators for both districts. Field enumerators were selected based on their familiarity with local languages, survey methodology and past experience with IPM CRSP activities in Uganda. The main objectives of the training workshop were to review and revise the survey instrument, design the sampling framework, and make logistical arrangements for the conduct of a pre-test of the instrument.

2.3 Sampling Design

A multi-stage sampling procedure was used to select eight villages in the two subject districts in Eastern Uganda (Table 1). In each district, four sub-counties were selected, including two sub-counties where the IPM CRSP had active programs and two others where the IPM CRSP had not previously been active. The selection of sub-counties where the IPM CRSP had not been active was based on geographical proximity and agro-ecological similarity to those where the IPM CRSP had been active. Villages in each sub-county were then purposively selected. In sub-counties where the IPM CRSP had been active, two villages were selected near NGOs that had worked with the IPM CRSP. In sub-counties where the IPM CRSP had not been active, villages were selected near an identified, active farmer NGO. Lists of farmers for each village were obtained from local council officials at the village level. A systematic random sample of 25 farmers was selected from each village, totaling 100 interviews in each district, and 200 interviews in all.

Table I. Number of Respondents by Sub-County and Gender

District/Sub-County	Total Respondents	Male Respondents	Female Respondents
Iganga District	100	51	49
Imanyiro	25	25	--
Baitambogwe*	25	13	12
Bulamagi*	25	13	12
Nakalama	25	--	25
Kumi District	100	45	55
Kumi	25	25	--
Atutur	25	--	25
Malera*	25	20	5
Bukedea*	25	--	25
Total	200	96	104

* Sub-Counties where the IPM CRSP has been active.

2.4 Interviewing

All surveys were completed by personal interviews conducted by one of the eight enumerators. Each enumerator completed 25 questionnaires. All interviews were completed by April 15th, and raw forms delivered to The Ohio State University by Dr. Kyamanywa prior to the annual IPM CRSP meetings held in June, 1999. Data was entered into Excel and then transferred to the SPSS statistical package for generating descriptive statistics.

Drs. Erbaugh and Kyamanywa participated in interviews with 20 farmers. Drs. Bashasha and Padde served as survey field coordinators in Iganga and Kumi Districts respectively. As experienced field social scientists, their role was to ensure quality, adherence to the sampling frame, response consistency, and promptness. Individual interviews generally lasted between 45-60 minutes. Interviews were conducted after the first rainy season had begun and crops had been planted. Selecting an appropriate interview date for farmers in Uganda is problematic since there are two rainy seasons throughout most of the country, and farmers generally stagger their planting dates. This results in farmers having to recall some information from the previous seasons.

3. Socio-Demographic Profile of Farmers Interviewed

3.1 Sample Size

The survey covered two districts, four counties, and eight sub-counties and villages in Eastern Uganda. There were 200 farmers interviewed, with 100 questionnaires completed in each of the two districts.

3.2 Gender

Of the survey respondents, 52% were female and 48% were male (Table 2). One reason that the number of female respondents was greater than males respondents was that Ahead-of-household@ was not used as a screening question. This was done intentionally to ensure that female agricultural decision-makers were well represented in the sample. Many have noted the important contribution women make to agricultural production and household food security in sub-Saharan Africa and Uganda (Saito et al, 1994; Blumberg, 1992). The results provide support for this approach. Out of the 104 female respondents, 36% reported being heads-of-household and the remaining 64% reported that even though they were not heads-of-households, they were knowledgeable of their farm enterprise. The distribution of respondents roughly mirrors that of the first baseline survey, where 49% of the respondents were female and 51% were male.

3.3 Age

The average age of respondents in this survey was 40 years and 42 years in the first baseline survey conducted in 1996 (Table 2). The age of farmers ranged from 20 to 77 with the largest percentage (27%) falling between 30 and 39 years (Table 3). The average age of respondents in Kumi was 43 years, which was older than the average age of 37 years found among respondents from Iganga. Kumi respondents were also found to be older than Iganga respondents in the first baseline study. In Iganga male respondents tended to be older than female respondents whereas in Kumi this was reversed with female respondents tending to be older than male respondents.

3.3 Educational Level

The percentage of respondents with a primary education are similar in the 1999 (56%) and 1996 (53%) surveys and the National Census Data from 1992 (55%), (Table 2). In the 1999 survey, farmer respondents from both Iganga and Kumi had roughly similar educational levels (Table 3). The average number of years of education for the total sample was nearly 7 years, which is equal to the number of years required for a primary leaving certificate. Only 9 respondents (4.5%) had no formal education, while the majority of farmers (63.5%) had primary education, 31% had secondary education, and 1% had post-secondary education. Women had more years of education than men in Iganga, and men averaged more years of education than women in Kumi.

3.4 Household Characteristics

Again, family sizes from the 1999, 1996, and 1992 National Census appear to be similar with an average of 8.6, 9.5 and 8 members, respectively (Table 2). Family size ranged from zero to more

than twelve with an average of 8.6 members per household for the total sample (Table 4). On average, Kumi respondents had larger household size (9.8 members) than Iganga (7.4 members) and female respondents in both Kumi and Iganga Districts reported larger average household sizes than male respondents.

Kumi respondents reported an average of 6.8 family members engaged in agriculture compared to 4.6 for respondents from Iganga (Table 4). Additionally, Kumi respondents reported an average of 4.3 children in school whereas Iganga reported an average of 3.2 children in school. Both of these results are not unexpected given the difference in average household size between the two districts. The district differences in household characteristics mirror those in gender: women reported larger average household size, more family members engaged in agriculture and more children in school than did men.

In Table 5, 48% of the respondents indicated that they are full-time farmers, with 82% indicating that they farm at least half-time farmers. Only 18% or 36 of the farmer respondents indicated that they spent less than half their time on agricultural activities. In Iganga district, 45% of the men and 76% of the women indicated they were full time farmers. In contrast, in Kumi district, 69% of the men and only 7% of the women said they were full time farmers.

3.5 Household Income

Agriculture was the major source of household income for 78% of the respondents (Table 6). The remaining 22% of the respondents indicated other major sources of household income including salaries, trading, brewing and casual labor. The information in Table 6 helps to explain the difference observed in Table 5 between the time spent on agricultural activities in Kumi and Iganga districts. Specifically, in Table 6 the female respondents in Kumi were more active in non-agricultural sources of income generation than Iganga.

Farm income was estimated by asking farmers to approximate their annual farm income using the categories found in Table 7. Income categories were used rather than specific amounts in order to: 1) reduce farmer apprehensions about providing this information; 2) compensate for the lack of record keeping by most Ugandan farmers; 3) obtain totals that might reflect farm sales that entail barter exchanges. A World Bank Country Study (1993) found that the average farm income in Uganda was US\$ 104 per annum. In this sample, the farm incomes averaged between US \$100 and \$200. Average farm incomes were slightly higher in Iganga than Kumi. Males in both districts reported higher farm incomes than women.

Off-farm income was estimated using the same intervals as farm income. Off-farm income averaged between US\$ 50 and \$100 for the total sample. Off-farm incomes were higher in Kumi than Iganga, perhaps reflecting a strategy to reduce the risks of farming in an area that has a more erratic climate and generally lower land productivity potential than many other areas of Uganda (Langlands, 1974). In both districts and for both males and female respondents, average farm income was higher than off-farm income.

When farm and off-farm incomes are added to form an aggregate measure of total household income the modal income grouping for Iganga was US \$400 to 500, whereas in Kumi the modal group was US \$100 to 200 (Table 8). However, average total household incomes for both districts were within the same range of US\$ 300 to 400, which is in line with per capita income estimates for Uganda (World Bank, 1993).

3.6 Land Holding and Use Characteristics

The average farm size for Iganga (2 hectares) was closer to the average obtained from the National Census (Table 2). That average farm size was larger in Kumi (5.4 hectares) reflects the different agroecological and production characteristics of the Teso farming system. Males reported larger average farm sizes than women in Iganga (1.4 hectares vs. 1) while women reported larger farms than men in Kumi (4.9 hectares vs. 4.3). However, males reported having more hectares in crops in both districts perhaps reflecting their greater access to resources. When comparing the 1996 to the 1999 survey, there was not much change in hectares in crops for most groups. However, male farmers in Kumi have increased their hectares in crops from 1996 to 1999 from 2.9 to 3.6 hectares. This may be because of restocking efforts in Kumi which led to a substantial increase in the number of animals available for traction and the capacity to cultivate more land.

Many maintain that sustainable agricultural production in sub-Saharan Africa is threatened by resource degradation stemming from increased population pressure and intensified use of the land, including reduced fallow periods (Reganold et al. 1990; Conway and Barbier, 1990). Goldman (1995) asserts that pests and diseases are the main cause of crop declines in sub-Saharan Africa. However, the relationship between land use intensification and increased incidence of pests and diseases has yet to be fully established (Teng et al., 1993).

Intensity of land use was measured using a system developed by Ruthenberg (1980:15) to classify the intensity of rotational systems. It uses the relationship between crop cultivation and fallowing as criterion. The formula for cultivation frequency is the number of years a unit of land is consecutively cultivated multiplied by 100 and divided by the length of the cropping cycle (consecutive years of cultivation plus length of fallow). This formula produces an R-value that extends from 0-100 and is used to order major rotational systems. Lower values (<33) are associated with shifting systems; fallow systems are related to intermediary scores (33 < R < 66); and permanent cultivation systems are associated with higher values (> 66). In other words, the larger the R value, the more intensive the cultivation system. Another related measure is the intensity of land cropping, which is measured by multiplying the land in crops by 100 and dividing this by the total available land. This gives a percentage of land under cultivation during the current growing system, and provides an indication of the potential for fallowing. Distributions on these two measures of land use are found in Table 10.

Land use intensity and cultivation frequency are greater in Iganga than in Kumi (Table 10); however, both measures of land use increased in both districts between the 1996 to 1999 surveys. Increasing land use intensity in Iganga and Kumi is a result of population growth. Iganga has the third highest district population density in Uganda, which helps explain its low average farm size relative to Kumi. As indicated above, male farmers in Kumi have increased their hectares in crops and their land use intensity has also increased between the 1996 and 1999 surveys. Again, return of cattle for traction, a male domain in Kumi, appears to have contributed to increasing land use intensity. This observation is supported by information in Table 11, that shows a particularly high use of animal traction for cultivation in Kumi (96% of respondents). Also, between the 1996 and 1999 surveys the magnitude in the difference in land use intensity between the two districts has decreased. The process of land use intensification appears to be increasing in both districts leading to declining biodiversity. The impact this will have on pests and disease incidence remains a topic requiring further investigation and validation.

3.7 Use of Agricultural Support Services and Inputs by District and Gender

Data in Table 12 indicate that farmers in Iganga have more extension contacts (77% had contact) than farmers in Kumi (where 67% had contact). There is little difference in extension contacts between male and female respondents in Iganga, however, in Kumi a higher percentage of females than males had extension contacts. This is probably attributable to many of the women in the sample from Kumi being members of the women's agricultural association, BUWOSA. The most frequently cited sources of agricultural information for the total sample, in order of importance, were agricultural extension, friends, farmer association, and radio (Table 13). Males in both districts cited the following sources of agricultural information as the most important: extension, friends, and radio. Females in both districts also ranked extension as the most importance source of agricultural information; however, they ranked farmer associations as the second most important source of information. Females in Iganga ranked friends and females in Kumi ranked radio as the third most important source of agricultural information.

Farmers in Kumi are more likely than farmers in Iganga to use formal credit, hired labor, exchange labor, purchased seed, and insecticides (Table 14). Farmers in Iganga are more likely than farmers in Kumi to use fertilizers and fungicides. No farmers in either district reported using herbicides, and total use of fertilizers and fungicides was relatively low (3 to 14 % of respondents across districts). Credit use in Kumi is almost entirely explained by credit provided by BUWOSA to its women members. The reported use of hired labor by farmers in both districts remains very high. In 1996, 80% of the sample reported use of hired labor; in 1999, 73% of the sample reported using hired labor. Reported use of both hired and exchange labor were higher in Kumi than in Iganga, and females in Kumi were more likely than males to use both of these forms of labor. There is a long cultural tradition of using exchange labor in Kumi. The use of purchased seed was high in both districts, with 86 and 94 percent of the farmers in Iganga and Kumi, respectively, reporting the purchase of seed. Rather than indicating the purchase of improved seed, this probably reflects problems in storing seed for the next season or a lack of seed held in reserve.

4. Crop Production and Marketing

4.1 Cash and Food Crop Prioritization

Farmers in both Iganga (Table 15) and Kumi (Table 16) ranked their most important cash and food crops in the initial participatory assessment (1995), the first baseline survey (1996) and the second baseline survey (1999). The results appear to be relatively consistent, with a few minor changes. In Iganga, the IPM CRSP has been focusing on maize, beans and groundnuts. Farmers continue to rank maize, beans and to a lesser degree groundnuts as important cash and food crops. Maize is the most important cash crop and second most important food crop. Minor changes are the appearance of cassava and tomatoes as important cash crops. In Kumi the IPM CRSP focal crops are groundnuts, cowpea and sorghum. Groundnuts and cowpea continue to be important cash and food crops. Sorghum retains its position as an important but not preferred food security crop. The most important change in the Kumi food rankings is the reappearance of

cassava as an important cash and food crop. Cassava mosaic virus decimated cassava when the project began in 1995, and farmers had quit growing it. The development and dissemination of resistant varieties has returned this crop to its former place of importance in the Teso farming system.

4.2 Plot Size for Focal Crops

Plot sizes for IPM CRSP focal crops (Table 17) tend to be larger in Kumi than in Iganga for both cereals and legumes. This corresponds with farm size and land use information in Tables 9 and 10. Overall, field plots for groundnuts appear to be the smallest in Iganga averaging .13 hectares, and largest in Kumi, averaging .75 hectares. This underlies the centrality of groundnuts to the Kumi farming systems and the declining importance of groundnuts in Iganga. According to extension agents from Iganga, this decline is largely attributable to groundnut rosette disease. Average male plot size by crop is larger than female plot size for all crops except groundnuts in Iganga, although differences do not appear to be large. The largest discrepancies in plot size for male and female farmers, however, appear to be associated with important cash crops including maize, cowpea and groundnuts (in Kumi, only for groundnuts).

4.3 Agronomic Information by Focal Crop

All except one farmer in Iganga grew maize during both rainy seasons (Table 18), and nearly 75% reported intercropping maize with beans most commonly, but also with beans and groundnuts. Over half of the farmers (57%) grew more than one variety of maize with the average number of maize varieties per farmer being 1.69. Longe-1 was the most commonly reported and preferred variety being grown.

Most farmers in Iganga reported growing beans during both seasons (Table 19), and 76% reported intercropping beans almost exclusively with maize. Most farmers (81%) were growing two varieties of beans or more, with the average number of bean varieties per farmer being 2.17. At least 8 different bean varieties were reported being grown. The two most commonly grown bean varieties were an older variety, Kanneyebwa, and a variety released in 1996 named K132, but locally known as Mutike. However, Kanneyebwa was the variety preferred by the most farmers. Farmers indicated that the newer varietal releases produce well but don't taste as good as the older varieties.

Groundnut production parameters (Table 20) are different in Iganga and Kumi districts. In Iganga, groundnuts are generally grown during both seasons (62%) and are commonly intercropped with maize. In Kumi, most farmers (82%) reported growing groundnuts only during the first season, and the majority (66%) grew them as a mono crop. Interestingly, when groundnuts are grown as an intercrop in Kumi they are most commonly grown with maize. The majority of farmers in Iganga (60%) grew only one variety of groundnuts with the average number of groundnut varieties per farmer in Iganga being 1.56. In Kumi, only 15% of the farmers reported growing only one variety; 85% reported growing 2 varieties or more, and the average number of groundnut varieties per farmer in Kumi was 2.56. The most commonly grown and preferred groundnut varieties in Iganga were red beauty and kabonge. In Kumi the most commonly grown groundnut varieties were the old variety erudurudu and the new rosette resistant variety Igola-1. Igola-1 and another old variety, otiira, were the most preferred varieties in Kumi.

In Kumi, sixty percent of the farmers reported growing sorghum during both seasons (Table 21). The majority (66%) of sorghum is grown as a mono crop; however, when intercropped it is grown with maize or millet. The average number of different varieties being grown per farmer is 1.9. The most commonly grown and preferred sorghum is a local red-seeded variety locally known as Iyera or Edima.

Cowpea was traditionally grown only during the second season rains in Kumi (Table 22). However, half the farmers in this sample reported growing cowpea during both seasons. Some farmers indicated that this was because cowpea was now an important cash crop. Others indicated that it was impossible to save cowpea seed from one season to next because of storage depredations by bruchids, thus necessitating its planting. The majority of farmers (82%) were growing cowpea as a mono crop. The average number of cowpea varieties per farmer was 1.47, reflecting the low genetic diversity of this crop. The most commonly grown and preferred cowpea variety is Ebelat.

4.4 Crop Marketing

As was the case in 1996, maize is still predominately a commercial crop with 73 percent of the respondents in Iganga reporting that they marketed half or more of their maize crop (Table 23), compared to 62 percent in 1996. Cowpea was the next most commercial with 42 percent of the respondents marketing half or more of their crop while 52 percent did in 1996. Thirty-eight percent of the respondents reported marketing half or more of their sorghum and bean crops, compared to 5 percent for sorghum and 27 percent for beans in 1996. In both Iganga and Kumi, only 24 percent of the respondents reported marketing half or more of their groundnut crop, with 40 percent stating that they did in 1996. Given that there are only two years of marketing information it cannot be ascertained if changes in the proportion of the crops being marketed represents a trend.

In Iganga, 59 percent of the respondents indicated that only men marketed maize (Table 24). Fifteen percent stated that only women market maize with the remainder reporting both men and women marketing the maize. Men (40%) were also more likely to market beans than women (20%). However, women were more likely than men to market groundnuts, sorghum and cowpea by 32, 45 and 30 percent of the respondents, respectively.

5. Pest Problems and Management Knowledge

5.1 Farmer Perception of Pest Priorities by Crop

Farmers in both districts have been asked to rank priority pests, diseases and weeds for each of the focal crops at three different times from 1994 to 2000. The most current rankings of pest priorities by crop appear in Table 25. Essentially these concur with those from the initial baseline survey conducted in 1996, thus confirming that project research priorities remain driven by farmer demand. One slight difference is that weeds, including *Striga*, were mentioned as important problems on all crops. The problem of weeds contributes to the commonly held perception by farmers that labor for weeding is an important production constraint. The scientific, common and local names of priority weeds are listed in Table 26.

Other changes in pest priorities between the two baseline surveys are described for each crop. For maize, the stalk borer complex and termites remain priority problems. For both maize

and beans, respondents no longer perceive the root rat as a priority problem and it has dropped from the rankings. Maize streak was the most frequently mentioned disease problem associated with maize despite the reported common use of Longe-1, a supposedly streak resistant variety. Whether this indicates that the genetic resistance of this open pollinated variety is breaking down following its 15 years in circulation, or farmers' long-term exposure and familiarity with the diseases is not known.

Several diseases and weeds are new to problem rankings with beans. New diseases commonly ranked are fusarium wilt, mosaic (BCMV), and bacterial blight. Although it was more common for farmers to mention weeds as a general problem, they specifically mentioned *Commelina* sp. as problem with beans.

Asking farmers in Iganga their groundnut pest priorities was done for the first time in this survey. Rosette disease (GRV) comes out as the top priority on groundnuts in Iganga and a relatively new pest, the groundnut leaf miner (*Aroarema modicella*), is the top priority in Kumi. However, aphids the insect vector of GRV, and GRV are perceived as priorities in both districts. Farmers in Kumi (50%) were more likely to know that aphids are the vector of GRV than are farmers in Iganga (44%), which perhaps explains why they ranked aphids in front of rosette disease.

The parasitic weed, *Striga hermonthica* remains the priority problem on sorghum. Other problems on sorghum remain virtually the same except that stalk borer has surpassed smut as a priority. Whether this is attributable to the IPM CRSP's focus on stalk borer as opposed to smut is not known. Pest priorities for cowpea remain the same.

5.2 Knowledge of Pest Management Alternatives.

Although use of pesticides was the primary pest management practice, farmers were asked several questions about their knowledge of alternative pest management practices (Table 27). Farmers were asked to define IPM on a three-point scale where 0 indicated an inability to define IPM; 1, indicated a partial definition of IPM; and, 2, indicated a more complete definition. Partial and more complete definitions were scored if farmers mentioned one or more of the attributes of IPM including, reducing use of pesticides or using them selectively, using alternative practices besides pesticides to control pests, or protecting beneficial organisms. More farmers in Iganga than in Kumi, provided partial or more complete definitions of IPM. Men in Iganga and women in Kumi provided partial or more complete definitions of IPM. Farmers were also asked if they knew of other practices besides pesticides to control pests and diseases. There was a wide variety of alternative control methods mentioned including crop rotation, fallowing, increasing plant populations, roguing diseased plants, hand-removal of pest species, using homemade concoctions, use of locally available bio-rational products (e.g. tobacco, marigolds), and use of resistant or tolerant varieties. Farmers in Iganga knew of more alternative control practices than farmers in Kumi. Women in both districts knew of more alternative control practices than men.

5.2 Pesticide Use on Field Crops by District and Gender

Sixty three percent of the farmers in the survey reported using pesticides on their crops in the field. Pesticide usage by district and gender is presented in Table 28. Use of pesticides is most prevalent in Kumi district, where 82 percent of the respondents reported using pesticides as

compared to 44 percent in Iganga. There was not much difference in pesticide use between genders. Forty-one percent of the men and 47 percent of the women in Iganga said that they used pesticides. While in Kumi, 84 percent of the men and 80 percent of the women reported using pesticides.

Most farmers (28 percent) in Iganga used only one or two, although 6 percent did use 5 to 6 different types of pesticides (Table 28). Men tended to use a greater variety of pesticides than women. In Kumi, as the high number of pesticide users would suggest, farmers were using more different types of pesticides than in Iganga. For example, in Kumi, 27 percent of the farmers said that they used 3 to 4 pesticides, while only 10 percent reported doing so in Iganga. In Kumi, there was little gender differentiation in the number of pesticides used. A higher percentage of men than women used one or two pesticides. The same percentage of men and women used 3 to 4, and a higher percentage of women used 5 to 6.

The number of spray events was also different in the two districts, with farmers in Kumi averaging 6.6 spray events per season and those in Iganga averaging 3.9. The difference between the number of spray events by gender in Kumi was small, with men spraying an average of 6.5 times and women 6.7 times. However in Iganga, there is a gender difference, with men reporting spraying an average of 5.3 times and women only 2.5 times.

5.3 Pesticide Usage by Crop

The crops most likely to be sprayed with synthetic pesticides (Table 29) were cowpea (79%), tomato (70%) and groundnuts (40%). Although eight farmers in Kumi reported that they had not used pesticides on tomatoes, their production was extremely small (less than one tenth of an hectare), and might have reflected the phrasing of the question by the interviewer. It is generally accepted that pesticides, particularly fungicides, are required to grow tomatoes successfully in Uganda. The use of pesticides is still considered an essential input in the production of cowpea, as in 1996 when 76 percent of cowpea growers indicated using pesticides. Cowpea growers continue to report that, “if you don’t spray cowpea, you lose”, owing to the pest complex associated with this crop. The percentage of farmers reporting spraying groundnuts (40%) is down slightly from the 1996 baseline survey (42%). This may be an artifact of this study or it might reflect the large number of farmers (65%) in Kumi district who are now growing the rosette resistant variety, Igola-1. Very few farmers use pesticides on maize or sorghum. Those who did were trying to control stem borers.

5.4 Commonly Used Pesticides

Overall, farmers identified 18 different pesticides being used on their field crops. Ten percent of the farmers were unable to identify the pesticides they were using (Table 30). Farmers were generally unable to separate trade from common names. The most common pesticides used in both districts were Ambush (permethrin), Rogor (dimetholate), dimecron, agrocytrin, Sumithion (fenitrothion), endosulfan, Agro, and malathion. Dithane/M45 was the most commonly reported fungicide.

5.5 Farmers' Reasons for Using and Not Using Pesticides

The majority of pesticide users in both districts, regardless of gender, spray in order to prevent pest and disease infestations and usually do so on a calendar basis (Table 31). Spraying to control pests and diseases using scouting and other pesticide-use decision making tools is used by a minority of respondents, although there is almost a 50/50 split between these two approaches to pest management among women in Kumi. The major reason that respondents stated for not using pesticides was that they were too expensive. Only one woman in Kumi indicated “safety” concerns, as her main reason for not using pesticides.

5.6 Method of Pesticide Application

The most common methods of applying pesticides in both districts were hiring someone to spray, borrowing a sprayer, or using ones' own sprayer (Table 32). Only three percent of the respondents in both Kumi and Iganga reported applying pesticides by hand. Differences between men and women on method of spraying were small, however, for those in Kumi who do not own sprayers, men were more likely to borrow a sprayer and women were more likely to hire someone to do the spraying.

5.7 Where Pesticides were Purchased

In Iganga, pesticides were generally purchased at farm shops in the towns of Iganga or Mayuge (Table 33). In Kumi, pesticides were usually purchased from the local markets that occur on a weekly basis throughout the district and at farm shops in Kumi Town. However, a number of Kumi farmers reported purchasing their pesticides in Mbale or even as far away as Kampala.

5.8 Sources of Pesticide Information

The most important source of pesticide information in both districts was extension agents (Table 34). The next most important source was vendors at a local market followed by pesticide labels. In both districts, more women than men indicated that extension agents were their most important source of pesticide information. Men in Kumi were more likely to get their pesticide information from vendors at local markets. Men in both districts were more likely than women to obtain information from labels on the pesticide package.

5.9 Household Pesticide Decision-Making

Decisions on pesticide usage, purchase of pesticides, and pesticide application appear to be largely the responsibility of men (Table 35). However, for pesticide use decision making, it appears that men are more likely to report that they are decision makers, whereas women report that either they are the decision makers or both husband and wives share decision making. Even so, in Iganga, 50 percent of the respondents said that men made decisions about pesticide usage, and in Kumi, 40 percent reported that men made these decisions. About the same percentage of women made these decisions in both districts, while more (32 versus 23 percent) decisions were shared in Kumi.

5.10 Attitudes Towards Pesticide Use

In Table 36 three questions were used to assess farmer attitudes about pesticides. In general, respondents in Kumi viewed pesticides as safer to use than did respondents in Iganga. Gender perceptions of safety differed in the two districts. In Iganga, with a mean score of 1.49 for women versus 1.08 for men, women tended to view pesticides as safer to use. In Kumi, the situation was reversed, with men feeling pesticides were safer to use than women, with mean scores of 1.69 and 1.18, respectively.

In terms of whether or not pesticides increase yields, while three percent of the respondents in Kumi replied never, all remaining respondents in both districts replied sometimes or always, indicating overall positive perceptions of pesticides. In general, Iganga respondents indicated that pesticides were more likely to increase yields than did respondents in Kumi. This may reflect dissatisfaction with pesticides that are repackaged, diluted, and resold to farmers at local markets in Kumi. Again, there were gender differences in opinions between the districts. In Iganga, women tended to believe that pesticides were more likely to increase yields than men (mean score of 1.80 for women versus 1.57 for men). In Kumi, men were more optimistic than women about the effect of pesticides on yields (mean score of 1.71 for men versus 1.29 for women).

The majority of farmers in both districts would always like to use more pesticides. Sixty-five percent of the farmers in Iganga, and 77 percent of the farmers in Kumi, stated that they would always like to use more pesticides. The same gender split across districts that was noted in the other parts of the table is also apparent here. Eighty-two percent of the women in Iganga said that they would always like to use more pesticides, while only 49 percent of the men did. In Kumi, 91 percent of the men said that they would always like to use more pesticides, while only 66 percent of the women said they would.

Overall, it appears that farmers in both districts have favorable attitudes regarding pesticide use. Overt behaviors including adoption of innovations are influenced by positive attitude formation (Rogers, 1971:112). This statement is supported by the results provided in Table 37. In both districts, 73 percent of the respondents indicated that their pesticide usage has increased over the past four years. The same pattern of responses observed in Table 36 reappear in Table 37. More farmers in Kumi (78%) than in Iganga (66%) indicate that their pesticide usage has increased. The same gender differences persist between districts, with more women in Iganga reporting an increase in pesticide usage than men, with the response pattern reversed in Kumi.

Given the results reported in the above paragraphs it seems that more positive attitude formation has led to increased pesticide use. Thus, it would appear, that sampled farmers in Iganga and Kumi are poised on the brink of the pesticide treadmill.

5.11 Pesticide Safety Practices

There were three questions used to assess if farmers were using basic safety practices in their use of pesticides: reading instructions on the label before using, wearing protective clothing, and washing immediately after use (Table 38). A slim majority of pesticide users stated that they always read labeling instructions before applying pesticides. However, more women than men say they read the instructions in both districts. Since men are the predominant pesticide applicators, this finding suggests that to some extent pesticides are not being applied according

to label recommendations. Additionally, 23 percent of the pesticide users in Iganga, and 28 percent in Kumi replied that they never read the label.

Use of protective clothing is another area of concern. Fifty-seven percent of the pesticide applicators in Iganga and sixty three percent in Kumi said that they “never” wear protective clothing. In both districts more women sometimes or always wear protective clothing. Eighty percent of the pesticide users in both districts replied that they washed immediately after using pesticides. Gender differences in washing after use was not large.

5.12 Post-harvest Pest Management by Crop

A majority of farmers indicated that they always had pest problems when storing sorghum and cowpea (Table 39). However, a majority of farmers always or sometimes had pest problems when storing maize, beans and groundnuts (only in Kumi). Weevils or bruchids are the main storage pests on sorghum, cowpea, maize and beans (Table 40). Rats were the most important storage problem with groundnuts. Farmers in Kumi commonly stored their sorghum and cowpeas with atelic insecticide (Table 41). Sun-drying was a common post harvest practice for all crops except groundnuts. Indigenous storage additives included mixing grain with ash, chilies, and storing the product without having first threshed the grain. Several farmers indicated using post-harvest storage methods extended by the IPM such as solar-drying using plastic, storing grain with tobacco or marigolds. However, it appears that IPM CRSP storage practices had not diffused beyond contact farmers.

5.13 Findings

Results from this study indicate that pest and disease priorities established by farmers for each of the priority crops during the participatory assessment conducted in 1995 are still relevant targets for IPM research. The one major alteration is that farmers in Kumi District now rank the leaf miner (*Aroarema modicella*) as the most important problem on groundnuts, surpassing, for the first time, aphids and groundnut rosette disease.

Farmers in Iganga and Kumi Districts continue to rely on synthetic pesticides as their primary method to control pests and diseases. Sixty-three and thirty three percent of the farmers in this sample reported using synthetic pesticides on their field crops and in post-harvest storage respectively. Weeding by hand remains the predominant form of weed control. The crops most likely and most frequently sprayed are cowpea and groundnuts. Farmers in Kumi (82%) are more likely to use pesticides than are farmers in Iganga (44%). The majority (60%) sprayed in order to prevent pest outbreaks rather than to control pests following field observation.

Knowledge of pest management alternatives and IPM is more pronounced with those farmers who have participated in IPM CRSP activities (see the next section). However, only forty five percent of the farmers in the sample could name a pest management alternative to pesticides and only twenty one percent of the farmers were able to identify a beneficial arthropod.

Although more than half of the farmers have some safety concerns regarding the use of pesticides, nearly seventy percent believe that pesticides lead to increased yields and seventy one percent would like to use more pesticides. Reinforcing these overall positive attitudes towards pesticides is the perception shared by seventy three percent of the farmers, that over the last four

years their use of pesticides has increased. It appears that in the absence of alternatives, the use of pesticides is proliferating and that farmers are on their way to joining the pesticide treadmill.

Post-harvest pests are important problems in the storage of maize, beans, cowpea and sorghum. Weevils or bruchids are the most important storage problems with these crops. Rats are the most important storage problem associated with the storage of groundnuts.

6. Impact of IPM CRSP Activities On Farmers' Knowledge and Awareness of IPM

6.1 Introduction

The IPM CRSP (Collaborative Research Support Program) has been applying a farmer participatory IPM strategy at on-farm research sites in Eastern Uganda since 1995. Farmer participation at each stage of the research process provided the nexus for an emerging synthesis of both ecological and traditional approaches. An objective of the second baseline study was to evaluate the impact of IPM CRSP activities to-date on farmers' knowledge and awareness of IPM.

6.2 Methodology

The assessment of project impacts used in this study followed the hierarchical target/outcome structure suggested in the Targeting Outcomes of Programs (TOP) model of Bennett and Rockwell (1995). Their model involves seven stages to guide both program development and assess program performance. This evaluation is conducted at the third stage, or KASA. The TOP model assumes that changes in knowledge, attitudes, skills, and aspirations (KASA) lead to changes in practices, that in turn, create the desired change. Increased knowledge and awareness are generally considered prerequisites to the adoption of new practices and technologies, including IPM (Rogers, 1995).

Questions to assess project impacts were incorporated into the survey instrument. Farmer knowledge and knowledge gaps of on-farm ecological relationships, priority pests and diseases, and pest management practices, suggested questions for assessing knowledge and awareness change. This included a series of questions that required farmers to identify pests and diseases from enlarged photos and specific questions about pest and disease management practices.

6.3 Comparison Group Identification

An important objective of the sampling procedure was to have comparison groups composed of project participants and non-participants. Participation was established by asking respondents if they had participated in two or more IPM CRSP activities. Participation in the IPM CRSP is a trichotomous variable with (0) indicating no participation (N=142), (1) indicating participation in 1 or 2 activities (N=34), and (2) indicating participation in three or more activities (N=24). For some analyses, the participation variable was made dichotomous yielding non-participants (N=142), and participants (N=58).

6.4 Group Comparability

Using a T-test of mean differences, the two groups were compared on the basis of socio-economic criteria including sex, age, years of education, farm income, and acres in crops. Comparisons of non-participants and participants on key socio-economic variables provide some indication that programmatic activities may be reaching older, larger and wealthier farmers (see Table 42), although mean differences were not dramatically large even for those that were statistically significant.

Additional T-tests of mean differences were conducted on the 100 participants (n=58) and non participants (n=42) from sub-counties where the IPM CRSP had active programs. The results were somewhat the same. Compared to non participants, participants were farmers with more acres in crops and more farm income. Within these IPM CRSP targeted sub-counties, participants were also more likely to be female and had higher levels of education. However, the difference in age was no longer statistically significant.

6.5 IPM Knowledge

The project did not begin with a rigid predetermined definition of IPM, because local and contextual pest management experience was not known. Since IPM is a multi-dimensional concept (Dent, 1995), it was decided to let important dimensions emerge from participatory activities. In recognition of farmers' preference for using pesticides it was decided to retain and promote "IPM" as a brand name for pest management alternatives that would supplant or moderate chemical pesticide usage. Each of the knowledge attributes or dimensions selected was considered fundamental to a strong working knowledge of IPM.

A summated ratings scale consisting of four attributes of IPM was devised to measure farmers' knowledge of IPM. The coefficient of reliability for the knowledge of IPM scale was .72, indicating an acceptable level of reliability (Nunnally, 1978:245). The first item requested interviewers to evaluate farmers' ability to define dimensions or attributes of IPM. The second item asked farmers if they were aware of any harmful effects from using pesticides. A third item asked farmers if they could name any beneficial insects. The fourth item asked farmers if they knew other practices to control pests and diseases besides using pesticides.

Table 43 presents the mean IPM Knowledge scores by the three different levels of IPM participation. The majority of respondents (71%) have not participated in IPM CRSP activities. This is not surprising considering that half the villages in the sample were deliberately selected because they had not participated in IPM CRSP activities. The hypothesis tested is that participation in IPM CRSP activities had a positive impact on knowledge of IPM. An analysis of variance (ANOVA) presented in Table 42 provides evidence that overall, those who participated in more IPM activities have greater knowledge of IPM than those who have not participated.

6.6 Knowledge of Crop Specific Pests, Diseases and Management Alternatives

In order to assess knowledge accrual impact from IPM CRSP activities, a set of test questions were developed for each of the project's priority crops. Since pest and disease identification was an early activity of the IPM CRSP, some questions pertained to enlarged photos of specific pests, diseases, or plant damage. Other questions asked for specific responses about resistant varieties,

post-harvest storage techniques, disease vectors, or control practices. Responses to these questions were combined to form an index of pest management knowledge for each crop, and a t-test used to compare means between participants and non participants (Table 44). For each crop specific knowledge scale, a statistically significant difference was found. In every case, mean scores were higher among farmers who had participated in the IPM CRSP.

6.7 Discussion

The results of this study indicate that more active farmer participation increases knowledge of IPM. This provides preliminary support for the participatory research and extension approach being used by the IPM CRSP in Uganda.

However, the analysis provides evidence that the number of project beneficiaries were small and may be more socio-economically advantaged. An important reason why more farmers have not participated may be the emphasis placed on using a participatory approach. Activities such as participatory assessments, farmer field monitoring, on-farm trials and field evaluations were generally limited to small groups of farmers in order to maintain program quality and to remain within project budgetary parameters.

The project made concerted attempts to ensure equal access to project activities even going to the extent of working with NGOs with exclusive female membership and conducting farmer open days. This helps explain why female participation was higher in IPM CRSP active subcounties. Efforts to be more inclusive of poorer farmers may have been confounded by the noted phenomenon that attendees at training programs are often the more aggressively innovative farmers, that is, those with better education, larger acreage, and higher farm income (Haug, 1999; Rogers, 1995). Participatory agricultural research (PAR) programs may not be a remedy for reaching the most marginalized in society and the conduct of agricultural research, even PAR, may self-select for those with the capacity to innovate and accept risks. Addressing the needs of the poorest of the poor, although a desirable objective will always be difficult particularly when the majority of farmers in a targeted community are small and resource poor.

7. Conclusions

7.1 Overall Impact

The project does appear to be having an impact on raising farmers' knowledge and awareness of IPM. However, whether or not enhanced knowledge and awareness will lead to adoption of IPM CRSP developed and recommended technologies, as is suggested by past studies in the diffusion of innovations, will be the subject of future investigations (Rogers, 1995).

7.2 Expanding Impacts

Efforts to broaden the number of farmers exposed to IPM and to IPM CRSP technologies have been pursued since 2000 through farmer field schools and by developing a proto-typical IPM training-of-trainers program for extension agents in Iganga District. These represent attempts to develop effective and efficient methods for disseminating information on IPM to a broader audience.

Working with and developing IPM information for extension agents would appear to be the most efficient method for expanding impacts. Farmers indicated that extension agents were their most important source of new agricultural information and on using pesticides. However, the Ugandan agricultural extension system has been recently reorganized for the third time in less than five years, thus making collaboration between the IPM CRSP and extension more complicated. Developing fact sheets, pesticide application, and safety materials, in which IPM goals and technologies are integrated, may be the most efficient way to reach this numerous and widely dispersed audience.

7.3 Adoption of IPM Technologies

Preliminary evidence indicates that adoption of IPM technologies and packages will be most rapid where results are most visible. The adoption of the improved, rosette resistant groundnut variety Igola-1 appears to be progressing rapidly in Kumi District. Although the IPM CRSP did not develop this variety, the project did launch a series of on-farm trials in 1996, to investigate and demonstrate its resistance to farmers. When compared to traditional varieties, the resistance and vigor of Igola-1 was apparent to all observers. Where technological component technologies provide less visible results, and conflict with other on-farm constraints such as lack of available labor for early planting, or lack of capital for purchasing additional seed for increasing plant populations, adoption rates may be slower and result in partial or modified patterns of adoption. Adoption of more complex technological components that require more knowledge of pests and diseases such as reduced and better timed spray programs, will also be slower and partial. It would be expected that farmers might alter and adopt certain components but not others resulting in partial adoption. Measuring adoption of these IPM packages will require field validation, and in the case of reduced and timely spraying, farmer record keeping.

7.4 A Strategy for Improving Adoption of IPM

Building on earlier analyses (Erbaugh, 1997) it would appear that an IPM research and dissemination strategy that targeted farmers using pesticides, or crops that farmers are more likely to spray with pesticides, would have a greater likelihood of success. This strategy would be justified on the explicit IPM goal of reducing the use of synthetic pesticides. Farmers willing and able to invest in pesticides to protect crops are conceivably more open to suggestions for reducing pesticide usage by adopting IPM practices (Morse and Buhler, 1997). Higher order analyses using data from this study indicates that farmers who have formed more negative attitudes of pesticides are also more knowledgeable of IPM. This suggests that farmers may have encountered negative impacts from using pesticides and may be actively seeking alternatives.

7.5 Socioeconomic implications of this strategy

Preliminary analyses indicate that targeting pesticide users or crops associated with pesticide use would not favor farmers who are economically advantaged. The only variable consistently associated with the more frequent use of pesticides is ownership of a backpack sprayer, a complementary technology. More education is only associated with greater knowledge and awareness of IPM. In general, pesticide use is consistently associated with the production of

particular crops, such as tomatoes, cowpea or groundnuts, regardless of farm income or farm size. Thus, it would appear that this strategy would not lead to an inequitable distribution of benefits favoring larger or wealthier farmers.

7.6 Gender

Evidence from this study and other preliminary analyses indicate that women may be as likely as men to adopt IPM technologies. An IPM strategy that targets pesticide users or crops associated with pesticide use would appear to not have a gender bias. Women appear as likely as men to be using and making decisions about the use of pesticides. However, men appear to be more likely to purchase and apply pesticides. Perceptions of pesticide safety and awareness of harmful impacts from pesticide use appears to vary more by district than by gender. The IPM CRSP should continue to encourage and ensure the participation of women in project activities.

REFERENCES

Bennett, C. and Rockwell, S.K. (1995). Targeting Outcomes of Programs (TOP): An Integrated Approach to Planning and Evaluation. Draft. Lincoln, NE: Cooperative Extension, University of Nebraska.

Blumberg, R.L. (1992). African Women in Agriculture: Farmers, Students, Extension Agents, and Chiefs. Development Studies Paper Series, Winrock International Institute for Agricultural Development, Morrilton, Arkansas.

Conway, G., and Barbier, E., (1990). After the Green Revolution: Sustainable Agriculture for Development. London: Earthscan Publications.

Dent, D., (1995). Integrated Pest Management. London: Chapman & Hall.

Erbaugh, J.M., (1997). Factors associated with the use of pesticides and implication for the development of IPM: A Ugandan case study. African Crop Science Proceedings 3: 1453-1463.

Goldman, A., (1995). Threats to Sustainability in African Agriculture: Searching for Appropriate Paradigms. Human Ecology. Vol. 23, No. 3, pps. 191-233.

Haug, R. (1999). Some leading issues in international agricultural extension, a literature review. The Journal of Agricultural Education and Extension, 5, 4, 263-274.

Langlands, B.W. (1974). "Soil Productivity and Land Availability Studies." Makerere University, Kampala, Uganda.

Morse, S., Buhler, W. (1997). Integrated Pest Management. Boulder: Lynne Rienner Publishers.

Nunnally, J. C. (1978). Psychometric Theory. New York: McGraw-Hill Company. p 245.

Reganold, J. R. Papendick, and J. Parr, (1990). "Sustainable Agriculture." Scientific American. June: 112-121.

Rogers, E. (1995). Diffusion of Innovation. New York: Free Press.

Rogers, E., Shoemaker, F., (1971). Communication of Innovation. New York: The Free Press.

Ruthenberg, Hans, (1980). Farming Systems in the Tropics. Oxford: Clarendon Press.

Saito, K., Mekonnen, H. and Spurling, D. (1994) Raising the Productivity of Women Farmers in Sub-Saharan Africa. World Bank Discussion Paper: 230. The World Bank, Washington, D.C.

Teng, Paul, Savary, S., and Revilla, I., (1993). "Systems of plant protection", in Crop Protection and Sustainable Agriculture. Ciba Foundation Symposium 177, John Wiley and Sons, New York, pps: 116-139.

Uganda Ministry of Agriculture, Animal Industries, and Fisheries (1992). Report on Uganda National Census of Agriculture and Livestock, Volumes I, II, and III. Entebbe, Uganda.

World Bank, (1993). A World Bank Country Study: Uganda. The World Bank, Washington, D.C.

=====

Table 2: Socio-Demographic Profile of Sampled Farmers in Iganga and Kumi Districts (Uganda, 1999).

	IGANGA			KUMI			Summary Data for Sample 1999	Summary Data for Sample 1996	National Census Data 1992
	Total	male	female	Total	male	female	96/104	51/49	NA
Respondents	100	51	49	100	45	55	200	100	NA
Age in years (mean)	37	40	35	43	41	44	40	42	48
Years of Education (mean)	6.9	6.8	7.0	6.6	7.0	6.5	*56%	*53%	*55%
Family Size (mean)	7.4	6.5	8.2	9.8	8.4	11	8.6	9.5	8
Farm Size (mean hec.)	1.9	2.2	1.7	5.4	4.8	5.9	3.7	6.9	2.4
Crop hectarage (mean hec.)	1.2	3.4	1.05	3.4	3.6	3.2	2.3	2.4	NA

* Percent with primary education.

Table 3: Age and Educational Profile of Farmers Interviewed in Iganga and Kumi Districts (Uganda, 1999)

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Age Class</i>							
20 to 29	31	13	18	17	14	3	48 (24.0)
30 to 39	34	21	13	20	9	11	54 (27.0)
40 to 49	18	7	11	35	8	27	53 (26.5)
50 to 59	10	5	5	22	8	14	32 (16.0)
Above 60	7	5	2	6	6	0	13 (6.5)
MEAN	37.43	39.55	35.22	42.77	41.20	44.05	40.10
STD DEV	12.53	12.74	12.04	11.75	14.85	8.35	12.41
<i>Educational Level</i>							
No schooling	5	3	2	4	1	3	9 (4.5)
Primary	59	32	27	68	28	40	127 (63.5)
Secondary	35	15	20	27	16	11	62 (31.0)
Post-Secondary	1	1	0	1	0	1	2 (1.0)
MEAN	6.96	6.84	7.08	6.70	6.98	6.47	6.83
STD DEV	3.15	3.57	2.67	3.39	3.22	3.55	3.27

Values in parentheses () are column percentages for all survey respondents.

Table 4: Household Characteristics in Iganga and Kumi Districts (Uganda, 1999)

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Family Size</i>							
0 to 4	20	10	10	6	4	2	26 (13.0)
5 to 8	51	33	18	38	20	18	89 (44.5)
9 to 12	24	8	16	33	17	16	57 (28.5)
> 12	5	0	5	23	4	19	28 (14.0)
MEAN	7.36	6.53	8.22	9.85	8.44	11.00	8.61
STD DEV	3.50	2.50	4.16	4.60	3.90	4.83	4.26
<i>No. of Family Members Engaged in Agriculture</i>							
1 to 4	58	35	23	32	21	11	90 (45.0)
5 to 8	31	14	17	38	21	17	69 (34.5)
9 to 12	9	2	7	23	3	20	32 (16.0)
> 12	2	0	2	7	0	7	9 (4.5)
MEAN	4.56	3.61	5.55	6.85	4.93	8.42	5.70
STD DEV	2.84	1.91	3.30	3.86	2.33	4.16	3.57
<i>No. of Children/Family in School</i>							
0	22	12	10	8	7	1	30 (15.0)
1 to 4	50	31	19	50	28	22	100 (50.0)
5 to 8	24	8	16	34	9	25	58 (29.0)
9 to 12	4	0	4	6	1	5	10 (5.0)
> 12	0	0	0	2	0	2	2 (1.0)
MEAN	3.16	2.43	3.92	4.30	3.04	5.33	3.73
STD DEV	2.79	1.88	3.35	2.95	2.12	3.15	2.92

Values in parentheses () represent column percentages.

Table 5: Time Spent on Agricultural Activities

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Time spent on agricultural activities</i>							
- full time	60	23 (45)	37 (76)	35	31 (69)	4 (7)	95 (47.5)
- half time	36	26 (51)	10 (20)	33	10 (22)	23 (42)	69 (34.5)
- less than half	4	2 (4)	2 (4)	32	4 (9)	28 (51)	36 (18.0)

Values in parentheses () are column percentages.

Table 6: Families Major Source of Household Income

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Major Source of Household Income</i>							
- Agriculture	80	46 (90)	34 (69)	76	42 (93)	34 (62)	156 (78)
- Salary	7	2 (4)	5 (10)	8		8 (15)	15 (7.5)
- Trading	12	2 (4)	10 (20)	1		1 (2)	13 (6.5)
- Brewing				9		9 (16)	9 (4.5)
- Casual Labor				3	1 (2)	2 (4)	3 (1.5)
- Other	1	1 (2)		3	2 (4)	1 (2)	3 (1.5)

Values in parentheses () are column percentages.

Table 7: Estimates of Farm and Off-Farm Incomes

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>* Farm Income Categories (in Uganda shillings)</i>							
No farm income	1	1	0	0	0	0	1 (0.5)
1. Less than 50,000	14	5	9	20	8	12	24 (12.0)
2. 51,000 - 100,000	26	10	16	31	14	17	57 (28.5)
3. 101,000 - 200,000	21	9	12	19	8	11	40 (20.0)
4. 201,000 - 300,000	30	12	8	12	6	6	42 (21.0)
5. 301,000 - 400,000	5	4	1	6	3	3	11 (5.5)
6. 401,000 - 500,000	6	5	1	6	4	2	12 (6.0)
7. > 500,000	7	5	2	6	2	4	13 (6.5)
MEAN	3.19	3.63	2.73	2.95	3.04	2.87	3.07
STD DEV	1.72	1.85	1.45	1.73	1.73	1.74	1.73
<i>Off-farm income</i>							
No farm income	29	22	7	3	3	0	32 (16.0)
1. Less than 50,000	15	1	14	33	12	21	48 (24.0)
2. 51,000 - 100,000	9	2	7	23	10	13	32 (16.0)
3. 101,000 - 200,000	24	13	11	15	7	8	39 (19.5)
4. 201,000 - 300,000	8	4	4	5	4	1	13 (6.5)
5. 301,000 - 400,000	6	4	2	6	1	5	12 (6.0)
6. 401,000 - 500,000	1	0	1	5	2	3	6 (3.0)
7. > 500,000	8	5	3	10	6	4	18 (9.0)
MEAN	2.29	2.25	2.33	2.74	2.84	2.65	2.51
STD DEV	2.13	2.35	1.90	2.03	2.16	1.94	2.09

* 1,000 Ugandan shillings to \$1 US.

Values in parentheses () are column percentages.

Table 8: Total Household Income Estimates

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Total Household Income Categories (in Uganda shillings)</i>							
No income	0	0	0	0	0	0	0
1. Less than 50,000	4	3	1	1	1	0	5
2. 51,000 - 100,000	10	6	4	9	3	6	19
3. 101,000 - 200,000	14	2	12	19	11	8	33
4. 201,000 - 300,000	13	7	6	13	4	9	26
5. 301,000 - 400,000	12	5	7	17	6	8	29
6. 401,000 - 500,000	16	7	9	11	4	7	27
7. 501,000 - 600,000	11	9	2	7	1	6	18
8. 601,000 - 700,000	5	3	2	6	3	3	11
9. 701,000 - 800,000	6	3	3	9	5	4	15
10. 801,000 - 900,000	2	1	1	2	2	0	4
11. 901,000 - 1, 000,000	4	3	1	3	2	1	7
12. 1,001,000-1,100,000	1	0	1	4	2	2	5
13. 1,101,000-1,200,000	1	1	0	2	1	1	3
14. > 1,201,000	1	1	0	0	0	0	1
MEAN	5.48	5.88	5.06	5.69	5.89	5.53	5.59
STD DEV	2.82	3.08	2.50	2.94	3.21	2.72	2.88

Table 9: Farm Size and Crop Hectarage

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Farm Size (in hectares)</i>							
< 1 to 1	34	13	21	2	1	1	36 (18.0)
1.1 to 3	51	27	24	29	19	10	80 (40.0)
3.1 to 5	10	7	3	33	12	21	43 (21.5)
> 5	5	4	1	36	13	23	41 (20.5)
MEAN	1.96	2.22	1.68	5.45	4.80	5.98	3.69
STD DEV	1.87	2.1	1.52	4.67	4.30	4.94	3.95
<i>Farm Area in Crops (in hectares)</i>							
< 1 to 1	52	25	27	2	1	1	54 (27.0)
1.1 to 3	46	24	22	51	25	26	97 (45.0)
3.1 to 5	1	1	0	30	10	20	31 (15.5)
> 5	1	1	0	17	9	8	18 (9.0)
MEAN	1.20	1.36	1.03	3.40	3.60	3.24	2.30
STD DEV	0.81	0.97	0.58	2.20	2.58	1.85	1.99

Values in parentheses () are column percentages.

Table 10: Land Use

	IGANGA			KUMI			
	Total	male	female	Total	male	female	
				0	45	55	200
Land Utilization							
-66%	31	14	17	34	8	26	65(32.5)
> 66%	63	33	30	61	36	25	124(62.0)
MEAN	73.95	73.71	74.20	73.01	83.97	64.04	73.48
STD							
< 33%	1	1	0	2	2	0	3 (1.5)
33 66%	34	19	15	36	10	26	70(35.0)
> 66%	65	31	34	62	33	29	127(63.5)
MEAN	75.60	75.45	75.75	69.65	78.30	62.58	72.62
STD DEV	23.92	26.11	21.68	21.27	24.14	15..54	22.77

Values in parentheses () are column percentages.

Table 11: Cultivation Method

	IGANGA			KUMI			
	Total	male	female	Total	male	female	
ndents Gender	100	51	49	100	45	55	200
Cultivation Method							
Use hoes only	79	36 (71)	43 (88)	0	0	0	79 (40)
Rent animal traction	0	0	0	39	21 (47)	18 (33)	39 (20)
Own animal traction	0	0	0	57	23 (51)	34 (62)	57 (28)
Rent tractor	20	14 (27)	6 (12)	3	0	3 (5)	23 (12)
Own tractor	1	1 (2)	0	1	1 (2)	0	2 (1)

Values in parentheses () are column percentages.

Table 12: Use of Agricultural Extension by District and Gender

	IGANGA			KUMI			
	Total	male	female	Total	male	female	
0 contacts	23	11	12	33	23	10	56 (28)
1 5 contacts	46	21	25	54	16	38	100 (50)
6 10 contacts	23	13	10	8	4	4	31 (15)
> 10 contacts	8	6	2	5	2	3	12 (7)

Most Important Sources o

							TOTAL
Respondents Gender	100	51	49	100	45	55	200
- Newspaper	0	0	0	3	2	1	3
- Ag. Extension	74	39					
Friend	40	28	12	30	22	8	70
- Family	3	1	2	13	5	8	16
-							
NARO	9	3	6	13	5	8	22
- Maker							
Books	0	0	0	2	2	0	2
- Farmers Assoc.	33	3	30	26	1	25	59
-							
Ag. Store	0	0	0	4	3	1	4
-							

* All respondents were asked to indicate their two most important sources of agriculture information.

Table 14: Use of Credit, Labor and Production Inputs by District and Gender

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Formal Credit Use</i>	9	1 (2)	8 (16)	30	3 (7)	27 (49)	39 (19.5)
<i>Hired Labor Use</i>	56	35 (69)	21 (43)	90	38 (84)	52 (95)	146 (73)
<i>Exchange Labor Use</i>	12	5 (10)	7 (14)	74	31 (69)	43 (78)	86 (43)
<i>Fertilizer Use</i>	14	6 (12)	8 (16)	4	1 (2)	3 (5)	18 (9)
<i>Purchased Seed</i>	86	44 (86)	42 (86)	94	40 (89)	54 (98)	180 (90)
<i>Use Insecticides</i>	44	21 (41)	23 (47)	82	38 (84)	44 (80)	126 (63)
<i>Use Fungicides</i>	12	10 (20)	2 (4)	3	2 (4)	1 (2)	15 (7.5)
<i>Use Herbicides</i>	0	0	0	0	0	0	0

Values in parentheses () are percent of respondents by gender, except in the Total column where values in parentheses indicate percent of total sample.

Table 15: Farmer Rankings of Important Cash and Food Crops from the PA, First Baseline and Second Baseline (Iganga District)

	CASH			FOOD		
Crops	PA	Base I	Base II	PA	Base I	Base II
Maize	1	1	1	1	2	2
Beans	3	3	3	2	4	3
Millet					6	
Groundnuts	4	4	4		5	6
Sweet Potatoes				3	1	1
Cassava			5	4	3	4
Banana		6		6	5	5
Coffee	2	2	2			
Soybean	5	5				
Sugarcane		6				
Tomatoes			6			

Rankings: The most important crop is indicated by a 1.

Table 16: Farmer Ranking of Important Cash and Food Crops from the PA, First Baseline and Second Baseline (Kumi District)

	CASH			FOOD		
Crops	PA	Base I	Base II	PA	Base I	Base II
Maize	4	5	6	2		6
Sorghum				6	3	3
Millet	6	3	4	1	1	5a
Groundnuts	1	1	1	3	4	2
Cowpea	2	2	3		6	4
Sweet Potatoes	3		5	4	5	5b
Cassava			2	5	2	1
Cotton		4				
Sunflower	5	6				

Rankings: The most important crop is indicated by a 1.

Table 17: Crop Hectarage by Focal Crop

Area in crop (hectares)	IGANGA			KUMI		
	Maize	Beans	Groundnuts	Groundnuts	Sorghum	Cowpea
< .5 or less	69	95	77	46	60	67
.6 - 1	27	3	0	31	28	16
1.1 - 2	4	0	0	16	8	11
2.1 - 5	0	0	0	6	2	3
Total Growing	100	98	77	99	98	97
MEAN	.44	.20	.13	.75	.625	.64
STD DEV	.275	.13	.11	.49	.43	.55
Mean Males	.49	.21	.09	.79	.63	.70
Mean Females	.39	.19	.15	.72	.62	.60

Table 18: Maize Varietal and Agronomic Information (Iganga only)

Varietal Name	No. of farmers reported growing	Farmer Varietal Preference
<i>Local</i>	54	24
<i>Kwanda</i>	11	0
<i>Longe 1¹</i>	88	72
<i>Hybrid²</i>	12	4
<i>Omusoga</i>	2	0
<i>popcorn</i>	5	0
No. of Maize Varieties being grown per farmer		
- one variety	43	
- two varieties	46	
- three	10	
- four	1	
<i>Average</i>	1.69	
Mono vs. Intercropping Maize		
- Monocropping only	25	
- Both mono & inter	23	
- Intercropping only	52	
- intercropping with beans		28
- intercropping with beans & gnuts		20
- intercropping with other		4
Season farmer plants maize		
- first season only	1	
- second season only	0	
- both seasons	99	
Total N Maize Farmers	100	

¹ Released in 1990 (open-pollinated).

² Hybrids have been released since 1997.

Table 19: Bean Varietal and Agronomic Information (Iganga only)

Varietal Name	No. of Farmers Reported Growing	Farmer Varietal Preference
<i>local</i>	8	1
<i>Kanneyebwa</i>	57	35
<i>Kabonge</i>	21	11
<i>K132, mutike, kawomera</i> ¹	57	22
<i>K131, kabalira, kazibwe</i> ²	34	10
<i>K20, Nambaale</i> ³	26	18
<i>white bean</i>	7	0
<i>haricort</i>	3	1
No. of Bean Varieties being grown per farmer		
- one variety	18	
- two varieties	50	
- three	24	
- four	6	
<i>Average</i>	2.17	
Mono vs. Intercropping Beans		
- Monocropping only	22	
- Both mono & inter	22	
- Intercropping only	54	
- intercropping with maize		52
- intercropping with other		2
Season plants beans		
- first season only	4	
- second season only	0	
- both seasons	94	
Total N beans Farmers	98	

¹ Newest bean variety released in 1996.² Released in 1993.³ Released 1990.

Table 20: Groundnut Varietal and Agronomic Information

Varietal Name	Farmers Growing in Iganga	Farmers Growing in Kumi	Farmer Preference in Iganga	Farmer Preference in Kumi
<i>red beauty, egoromoit /erudurudu</i>	32	68	25	20
<i>kabonge</i>	43		34	
<i>Igola - 1¹</i>	14	65	12	40
<i>mazungu, white valencia</i>	19		4	
<i>kasese, red valencia</i>	4		1	
<i>amasoga, etesot</i>	5	43		
<i>otiira</i>		41		34
<i>ebaya</i>		20		5
<i>other</i>	2	10	1	
Groundnut Varieties Grown per Farmer				
- one variety	46 (60)	15 (15)		
- two varieties	22 (29)	28 (28)		
- three	6 (07)	42 (42)		
- four or >	3 (04)	14 (15)		
<i>Average</i>	1.56	2.56		
Mono vs. Intercropping Groundnuts				
- Monocropping only	25 (33)	65 (66)		
- Both mono & inter	18 (23)	4 (04)		
- Intercropping only	34 (44)	30 (30)		
- with maize	32	24		
- with other	2	6		
Season Groundnuts Planted				
- first season only	15	83		
- second season only	0	6		
- both seasons	62	10		
Total N Groundnut Farmers	77	99		

¹ Improved variety with rosette disease resistance.

Table 21: Sorghum Varietal and Agronomic Information (Kumi only)

Varietal Name	No. of Farmers Growing	Farmer Varietal Preference
<i>Local (enyang, enyongai, ourien, others)</i>	9	
<i>Local red, Iyera, Edima</i>	49	57
<i>Local white, Ilodir Loakwangan, Ekonokamu</i>	36	
<i>Serena</i> ^{1a}	31	18
<i>Seredo</i> ^{1b}	11	3
<i>Sekedo</i> ^{1c}	7	5
<i>Erepete</i>	14	10
<i>Ikoli</i>	11	4
<i>Epurupur</i> ²	1	1
Sorghum Varieties Grown per Farmer		
- one	32	
- two	40	
- three	23	
- four	2	
Average	1.9	
Mono vs. Intercropping		
- Monocropping only	66	
- Both mono & inter	17	
- Intercropping only	15	
- intercropping with maize		5
- intercropping with millet		10
Season Plants Sorghum		
- first season only	17	
- second season only	22	
- both seasons	59	
Total N Sorghum Farmers	98	

^{1a,b,c} Improved varieties released in early and mid - 1980s.

² Most recently released improved variety.

Table 22: Cowpea Varietal and Agronomic Information (Kumi only)

Varietal Name	No. of Farmers Reported Growing	Farmer Varietal Preference
<i>Ebelat</i>	93	88
<i>Icurukukai</i>	23	2
<i>Kenyan, India - black seeded</i>	21	5
<i>Nigeria</i>	2	1
<i>Large White (SARI)</i>	1	1
No. of Cowpea Varieties being Grown per Farmer		
- one variety	55	
- two varieties	37	
- three	5	
- four	0	
<i>Average</i>	1.47	
Mono vs. Intercropping Cowpea		
- Monocropping only	80	
- Both mono & inter	3	
- Intercropping only	14	
- intercropping with maize		9
- intercropping with green gram		4
- intercropping with other		1
Season Plants Cowpea		
- first season only	9	
- second season only	37	
- both seasons	51	
Total N Cowpea Farmers	97	

Table 23: Proportion of Crops Marketed

	Maize	Beans	Groundnuts (Iganga)	Groundnuts (Kumi)	Sorghum	Cowpea
none marketed	12	39 (40)	42 (54.5)	52 (52.5)	42 (43.0)	38 (39.0)
< than half marketed	15	22 (22)	16 (21.0)	23 (23.0)	19 (19.0)	18 (18.5)
half marketed	25	23 (24)	12 (15.5)	16 (16.0)	26 (26.5)	15 (15.5)
>than half marketed	48	14 (14)	7 (9.0)	7 (7.0)	8 (8.0)	23 (24.0)
all marketed	0	0	0	1 (1.0)	3 (3.0)	3 (3.0)
Total	100	98	77	99	98	97

Values in parentheses () are column percentages.

Table 24: Gender of Person Marketing the Crop

	Maize	Beans	Groundnut s	Sorghum	Cowpea
None Marketed	7	21 (21.4)	52 (29.4)	17 (17.3)	18 (18.6)
Male	59	39 (39.8)	46 (26.0)	19 (19.4)	23 (23.7)
Female	15	20 (20.4)	57 (32.2)	44 (44.9)	29 (29.9)
Both Male and Female	19	18 (18.4)	22 (12.4)	18 (18.4)	27 (27.8)
Total	100	98 (100)	177 (100)	98 (100)	97 (100)

Values in parentheses () are column percentages.

Table 25: Farmer Ranking of Priority Pest Problems by Crop

Crop	Most Important	Second	Third	Fourth
Maize	stalk borer	termites	¹ weeds	maize streak
Beans	aphids	bean fly	² diseases	weeds
Groundnuts (Iganga)	rosette disease	Aphids	³ vermine	⁴ weeds
Groundnuts (Kumi)	leaf miner	Aphids	rosette disease	⁵ weeds
Sorghum	striga	stalk borer	smut	shootfly
Cowpea⁶	aphids	stink bug	⁷ weeds	blister beetles

¹ commonly reported weeds of maize include: blackjack, commelina, striga, couch grass

² commonly reported bean diseases include: fusarium wilt, mosaic (BCMV), bacterial blight

³ commonly reported vermine pests of groundnut include: mole rat and ground squirrels

⁴ commonly reported weeds on groundnut in Iganga include: striga, commelina, oxalis

⁵ commonly reported weeds on groundnut in Kumi include: couch grass, commelina, star grass

⁶ other cowpea insect pests frequently mentioned: otheca, maruca pod borer

⁷ commonly mentioned weeds of cowpea: star grass, couch grass, nut grass, oxalis

Table 26: Priority Weeds

Scientific Name	Common name	Teso	Lusoga	Problem Weeds as Indicated by Farmers/Crop					
				Maize	Beans	Groun dnuts (Iga.)	Ground nuts (Ku.)	Sorghum	Cowpea
<i>Cynodon dactylon</i>	star grass	emuria	Lufafa				X		X
<i>Panicum maximum</i>		egoromoit	Bisinde						
<i>Elusine africana</i>	wild finger millet	ekitu	Golo						
<i>Digitaria scalarum</i>	couch grass	ekolet	Lumbugu	X			X		X
<i>Imperata cylindrical</i>	spear grass	ebiat	Ibembe						
<i>Cyperaceae rotundus</i> Linn.	nutgrass	eriau	Enku						X
<i>Bidens pilosa</i>	blackjack	seere, eida	Obukaala	X	X	X			
<i>Oxalis latifolia</i>	oxalis		Kanunu, kateteyi	X		X			X
<i>Commelina benghalensis</i>		ekoropot	Eiranda	X	X	X			
<i>Striga hemonthica</i>	striga							X	

Table 27: Knowledge of IPM and Related Concepts

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Can define IPM</i>							
- no knowledge	71	35 (69)	36 (74)	76	37 (82)	39 (71)	147 (74)
- partial definition	24	13 (25)	11 (22)	19	7 (16)	12 (22)	43 (21)
- can define	5	3 (6)	2 (4)	5	1 (2)	4 (7)	10 (5)
<i>Knowledge of Beneficials</i>							
- no knowledge	80	43 (84)	37 (76)	78	36 (80)	42 (76)	158 (79)
- can provide one example	16	6 (12)	10 (20)	20	8 (18)	12 (22)	36 (18)
- can provide more than one example	4	2 (4)	2 (4)	2	1 (2)	1 (2)	6 (3)
<i>Knowledge of other methods to control pests besides pesticides</i>							
- no knowledge	50	29 (57)	21 (43)	59	28 (62)	31 (56)	109 (55)
- can provide one example	26	10 (20)	16 (33)	14	9 (20)	5 (9)	40 (20)
- can provide more than one example	24	12 (23)	12 (24)	27	8 (18)	19 (35)	51 (25)

Values in parentheses () are column percentages.

Table 28: Pesticide Usage by District and Gender

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Use Pesticides</i>	44	21 (41)	23 (47)	82	38 (84)	44 (80)	126 (63)
<i># of different pesticides by crop used per farmer</i>							
0	56	30 (59)	26 (53)	18	7 (16)	11 (20)	74 (37)
1 - 2	28	9 (18)	19 (39)	48	24 (53)	24 (44)	76 (38)
3 - 4	10	7 (13)	3 (6)	27	12 (27)	15 (27)	37 (19)
5 - 6	6	5 (10)	1 (2)	7	2 (4)	5 (9)	13 (6)
Mean	1.06	1.22	0.90	2.06	2.1	2.04	1.56
STDEV	1.54	1.78	1.22	1.58	1.46	1.69	1.63
<i># of spray events last season per farmer</i>							
0	56	30 (59)	26 (53)	18	7 (16)	11 (20)	74 (37)
1 - 4	18	7 (14)	11 (22)	22	8 (18)	14 (26)	40 (20)
5 - 8	12	4 (8)	8 (16)	34	19 (42)	15 (27)	46 (23)
9 - 12	2	1 (2)	1 (2)	11	6 (13)	5 (9)	13 (7)
> 12	12	9 (18)	3 (6)	15	5 (11)	10 (18)	27 (14)
MEAN	3.94	5.3	2.53	6.62	6.53	6.70	5.28
STD DEV	7.67	9.95	3.76	5.58	4.81	6.17	6.8

Values in parentheses () are column percentages.

Table 29: Pesticide Use by Crop

District	IGANGA				KUMI			
Crop	Maize	Beans	Groundnuts	Tomato	Sorghum	Cowpea	Groundnuts	Tomato
# Growing	100	97	77	14	98	97	100	17
# Spraying	9(9)	19 (20)	25 (32)	13 (93)	14 (14)	77 (79)	46 (46)	9 (53)
Mean # Spray Applications/Season	1	2	3.24	10.7	2.36	3.7	3.2	5.7

Table 30: Most Commonly Used Pesticides on Cowpea and Groundnut

Pesticide Name	Groundnut (Iganga)	Groundnut (Kumi)	Cowpea (Kumi)
Ambush	2	18	45
Dimetholate/Rogor/ Agrothroate	2	12	7
Dimecron	9	4	2
Agrocythrin	0	2	4
Fenkill	0	1	3
Decis	0	0	3
Ripchord	0	2	1
Fenom	2	0	0
Finitrithion/simthion	0	1	1
Salut	0	1	0
Malathion	0	0	3
Dithane/M45	0	0	1
Thiodine	0	1	0
Agro	0	1	0
Dudu-Hyper	0	0	1
Name Unknown	11	5	7

Table 31: Farmers' Reasons for Using and Not Using Pesticides

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Using Pesticides</i>	44	21 (41)	23 (47)	82	38 (84)	44 (80)	126 (63)

Table 33: Where Pesticides Normally Purchased

District	Iganga District	Kumi District
Use pesticides	44	82
Purchase Location		
- Local Market	1	47
- Ag. Stores in Kumi town		23
- Ag. Stores in Iganga town	29	
- Ag. Agent/Office	2	2
- Mbale		8
- Jinja	1	
- Kampala		2
- Mayuge	11	

Table 34: Main Source of Pesticide Information

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
Respondents Gender	100	51	49	100	45	55	200
Source Pesticide Information							
- not using	56	30 (58)	26 (53)	18	7 (16)	11 (20)	74 (37)
- label	6	5 (10)	1 (2)	11	6 (13)	5 (9)	17 (8.5)
- person at local market	1	1 (2)	0	24	15 (33)	9 (16)	25 (12.5)
- person at agriculture store	4	3 (6)	1 (2)	6	4 (9)	2	10 (5)
- extension agent	28	9 (18)	19 (39)	27	6 (13)	21 (38)	55 (27.5)
- family member or neighbor	1	1	0	5	3 (6)	2 (4)	6 (3)
- self knowledge	1	1	0	6	3 (6)	3 (5)	7 (3.5)
- NGO	3	1	2 (4)	3	1	2 (4)	6 (3)

Value in () column percentages.

Table 35: Pesticide Decision-Making

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Using pesticides</i>	44	21(41)	23 (47)	82	38 (84)	44 (80)	126 (63)
<i>Family member(s) who make pesticide use decision</i>							
- male (husband,son)	22 (50)	18 (86)	4 (17)	33 (40)	26 (69)	7 (16)	55 (44)
- female (wife,daughter)	12 (27)	1 (5)	11 (48)	23 (28)	2 (5)	21 (48)	35 (27.5)
- both	10 (23)	2 (9)	8 (35)	26 (32)	10 (26)	16 (36)	36 (28.5)
<i>Who purchases pesticides</i>							
- male (husband,son)	35 (80)	20 (95)	15 (65)	57 (70)	37 (97)	20 (45)	92 (73)
- female (wife,daughter)	4 (9)	0	4 (17)	17 (21)	0	17 (39)	21 (17)
- both	1 (2)	0	1 (5)	8 (10)	1 (3)	7 (16)	9 (7)
- other	4 (9)	1 (5)	3 (13)	0	0	0	4 (3)
<i>Who applies pesticides</i>							
- male (husband,son)	31 (71)	19 (90)	12 (52)	63 (77)	29 (76)	34 (78)	94 (75)
- female (wife,daughter)	7 (16)	1 (5)	6 (26)	3 (4)	2 (5)	1 (2)	10 (8)
- both	1 (2)	0	1 (5)	1 (1)	0	1 (2)	2 (1)
- hired male	5 (11)	1 (5)	4 (17)	15 (18)	7(19)	8 (18)	20 (16)

Values in parentheses () are column percentages of those using pesticides.

Table 36: Attitudes Towards Pesticide Use

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Are pesticides safe to use?</i>							
- never	7	7 (14)	0	11	4 (9)	7 (13)	18 (9)
- sometimes	58	33 (65)	25 (51)	37	6 (13)	31 (56)	95 (47.5)
- always	35	11 (21)	24 (49)	52	35 (78)	17 (31)	87 (43.5)
MEAN	1.28	1.08	1.49	1.41	1.69	1.18	1.35
STD DEV	0.59	0.59	0.51	0.68	0.63	0.64	0.64
<i>Do pesticides increase yields?</i>							
- never	0	0	0	3	0	3 (5.5)	3 (1.5)
- sometimes	32	22 (43)	10	46	13 (29)	33 (60)	78 (39)
- always	68	29 (57)	39	51	32 (71)	19 (34.5)	119 (69.5)
MEAN	1.68	1.57	1.80	1.48	1.71	1.29	1.58
STD DEV	0.47	0.50	0.41	0.56	0.46	0.57	0.52
<i>Would like to use more pesticides?</i>							
- never	2	2 (4)	0	0	0	0	2 (1)
- sometimes	33	24 (47)	9 (18)	23	4 (9)	19 (34.5)	56 (28)
- always	65	25 (49)	40 (82)	77	41 (91)	36 (65.5)	142 (71)
MEAN	1.63	1.45	1.82	1.77	1.91	1.65	1.70
STD DEV	0.53	0.58	0.39	0.41	0.29	0.48	0.48

Values in parentheses () are column percentages of those using pesticides.

Table 37: Perceptions of Pesticide Use Over the Last 4 Years by Pesticide Users

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents' Gender</i>	100	51	49	100	45	55	200
<i>Over the last 4 years, your pesticide use has...</i>							
<i>- decreased</i>	6 (14)	4 (19)	2 (9)	11 (13)	4 (11)	7 (16)	17 (14)
<i>- stayed the same</i>	9 (20)	5 (24)	4 (17)	7 (9)	3 (8)	4 (9)	16 (13)
<i>- increased</i>	29 (66)	12 (57)	17 (74)	64 (78)	31 (81)	33 (75)	93 (73)
<i>Total Using Pesticides</i>	44	21 (41)	23 (47)	82	38 (84)	44 (80)	126 (63)

Table 38: Pesticide Safety Practices

	IGANGA			KUMI			TOTAL
	Total	male	female	Total	male	female	
<i>Respondents Gender</i>	100	51	49	100	45	55	200
<i>Using pesticides</i>	44	21 (41)	23 (47)	82	38 (84)	44 (80)	126 (63)
<i>Read labeling instructions before using</i>							
- never	10 (23)	8 (38)	2 (9)	23 (28)	10 (26)	13 (30)	33 (26)
- sometimes	12 (27)	4 (19)	8 (35)	17 (21)	9 (24)	8 (18)	29 (23)
- always	22 (50)	9 (43)	13 (56)	42 (51)	19 (50)	23 (52)	64 (51)
<i>Wear Protective Clothing</i>							
- never	25 (57)	17 (81)	8 (35)	52 (63)	24 (63)	28 (64)	77 (61)
- sometimes	7 (16)	2 (9.5)	5 (22)	20 (24)	9 (24)	11 (25)	27 (21)
- always	12 (27)	2 (9.5)	10 (43)	10 (12)	5 (63)	5 (11)	22 (18)
<i>Wash immediately after use</i>							
- never	4 (9)	1 (5)	3 (13)	3 (4)	2 (5)	1 (3)	7 (6)
- sometimes	5 (11)	2 (9)	3 (13)	13 (16)	1 (3)	12 (27)	18 (14)
- always	35 (80)	18 (86)	17 (74)	66 (80)	35 (92)	31 (70)	101 (80)

Responses only from pesticide users.

Values in () parentheses are column percentages.

Table 39: Farmer Perception of Storage Problems by Crop

	Maize	Beans	Groundnuts (Iganga)	Groundnuts (Kumi)	Sorghum	Cowpea
Always a problem	48	43 (44)	6 (8)	12	61 (62)	60 (62)
Sometimes a problem	46	42 (43)	36 (47)	62	34 (35)	36 (37)
Never a problem	6	13 (13)	35 (45)	26	3 (3)	1 (1)
TOTAL	100	98	77	100	98	97

Values in parentheses () are column percentages.

Table 40: Farmer Ranking of Important Storage Pests

Storage Pest	Maize	Beans	Groundnuts	Sorghum	Cowpea
None	6	11 (11.2)	57 (32.2)	3 (3.1)	
Bruchids or Weevil	56	86 (87.8)		70 (71)	85 (87.6)
Rats	4		81 (46)	3 (3.1)	6 (6.2)
Termites			2 (1.1)		2 (2.1)
Red Ants			6 (3.4)		
Moths	21			16 (16.3)	1 (1.0)
Rotting			18 (10)		2 (2.1)
Weevil, rat, termite	11				1 (1.0)
Other or don't know name	2	1 (0.5)	13 (7.3)	6 (6.1)	
Total	100	98 (100)	177(100)	98 (100)	97 (100)

Values in parentheses () are column percentages.

Table 41: Farmer Storage Practice By Crop

Storage Practice	Maize	Beans	Groundnuts	Sorghum	Cowpea
None	9	3	73 (41)	5	2
Atelic				19 (19)	22 (23)
Malathion		1		5	6
Ambush					1
Pesticide (unknown)	8	7			
Rat Poison and Trapping	2		56 (32)	2	1
Sun Drying and Rat Poison	7		2	2	11 (11)
Cats			3	3	
Mixed with Ash		4	3	3	9
Sun Drying	64 (64)	57 (58.2)	5	32 (33)	19 (20)
Sell of Consume Early				3	8
Latana Camara or Marigolds	3				5
Solar Heater	2	3		1	1
Sun Drying and Ash		7		2	
Sun Drying and Dirt/Sand		3			
No Threshing		1		16 (16)	8
Dust/soil	1	3			
Air-Tight Container				3	
Tobacco					7
Chilies				4	4
Other	4	12 (12.1)			
Total	100	98 (100)	177 (100)	98 (100)	97 (100)

Values in parentheses () are column percentages for most frequently mentioned storage pest control practices.

Table 42: Summary of T-Test Analysis Means, Standard Deviations and Significance Level

Variable Name	Non-participants (N = 142)	Participants (N = 58)	T
Age	38.78 (12.53)	43.33 (11.58)	-2.38*
Sex	.507 (.501)	.414 (.496)	-1.196
Years of Education	6.65 (3.34)	7.27 (3.07)	-1.23
Farm Income	2.75 (1.64)	3.84 (1.69)	-4.23**
Acres in Crops	5.05 (4.28)	7.20 (6.00)	-2.84**

Values in parentheses () are standard deviations.

* t-test significant at $p < .05$

** t-test significant at $p < .01$

Table 43. Summary of One-Way Analysis of Variance of IPM Knowledge by Level of Project Participation.

IPM CRSP Participation	N	Mean	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
0 - none	142(71)	1.61	Between Grps	563.304	2	281.652	97.443	.000
1 - some	34(17)	3.76	Within Grps	5669.416	197	2.890		
2 - active	24(12)	6.58	Total	1132.720	199			
Total	200	2.58						

Values in parentheses () are column percentages.

F ratio for one-way analysis of variance significant at 0.5 level.

Table 44: Mean Scores on Crop Specific Pest Management Knowledge by Level of Participation.

Crop	Range	Group	N	Mean	t	Sig.
Maize (N=100)	0 - 5	No participation	66	1.18	- 6.74	.000
		Participation	34	3.00		
Beans* (N=98)	0 - 4	No participation	64	.406	- 6.56	.000
		Participation	34	2.03		
Sorghum (N=100)	0 - 6	No participation	76	3.26	- 3.44	.001
		Participation	24	4.17		
Cowpea (N=97)	0 - 6	No participation	74	3.24	- 4.88	.000
		Participation	23	4.70		
Gnuts (Iganga) (N=77)	0 - 5	No participation	49	1.61	- 3.59	.001
		Participation	28	2.53		
Gnuts (Kumi) (N=100)	0 - 5	No participation	76	2.42	- 5.44	.000
			24	4.04		

*Levene Test for Equality of Variances: F = 75.87; Sig:.000; Thus t-test for equality of Means, equal variances not assumed.